Workshop Report: Bulkley Morice Wildfire Resilience Project – Workshop 3

The third workshop of the Bulkley Morice Wildfire Resilience Project was held on December 3, 2025, to engage stakeholders, land managers, government representatives, and local interest groups in discussions about wildfire resilience strategies. The agenda was structured to build foundational knowledge of wildfire behaviour and its simulation in modelling, explore wildfire hazard modelling, and discuss the design of learning scenarios for wildfire management.

Workshop Objectives
- Build the wildfire knowledge foundation to inform planning and management actions
- Understand the strengths and limits of the BuMo wildfire model (TEF) by looking at how the model components simulate fire effects
- Present and review the beta version of the current conditions and the climate change hazard maps
- Present and discuss the design and purpose of learning scenarios

Key Activities:
1. Knowledge foundation – presentation with insights from the 2024 Jasper wildfire.
2. In-depth explanation of the application of the TEF wildfire model and its simulation of wildfire behaviour. Understand the strengths and limitations of the model. Discuss the impact of climate change on wildfire hazards.
3. Review the current beta versions of wildfire hazard mapping for the project area.
4. Discuss learning scenarios, their design, and purpose.

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1. Insights from Jasper Wildfire (2024)

Sources: FP Innovations- Jasper Wildfire Community Impact Research; Canadian Forest Service - Jasper Wildfire Complex 2024 Reconstruction

- **Impact**: 33,000 ha burned, 359 structures destroyed, $880M insured losses, 25,000 evacuated.
- **Historic Fire Regime:** A pattern of frequent, mixed-severity fires maintained a diverse vegetation mosaic with lower fuel loading and susceptibility to large crown fires
- Before the 19th century, fire was frequent, driven by both lightning and Indigenous burning practices.
- **Contributing Factors to 2024 wildfire**: Drought, rapid ignition, mountain pine beetle (MPB)-affected fuels, continuous fuel pathways, and extreme fire behaviour.
- **Insights (CFS)**:
    - Under extreme fire behaviour, wildfire suppression is ineffective.
    - Fire exclusion has shifted the landscape toward a more uniform, fire-prone structure, increasing the potential for large, uncontrollable fires
    - Fuel treatments reduced fire intensity and ember transport but did not stop the fire.
- **Community Impact Research (FPI):**

- Strong winds drove the structure-to-structure spread
- Once structure-to-structure ignition began, suppression resources were overwhelmed.
- Outside the townsite, continuous fuel pathways allowed wildland fire to ignite structures directly.

- **Resilience and Adaptation:**
  - Building wildfire resilience requires an integrated approach that includes landscape risk assessment, fire-resistant infrastructure, and pre-response planning.
  - Resilience has two dimensions: community resilience (minimizing damage to safety, property, and ecosystem services) and ecological resilience (maintaining ecosystem recovery or transition to acceptable states).

Conclusions: Community wildfire disasters are driven by a common sequence of factors—severe fire potential, extreme burning conditions, multiple ignitions within communities, and rapidly developing fire behaviour exceeding firefighting resources. Strengthening resilience requires an integrated approach, including landscape risk assessment and management, increased fire resistance in the built environment, and effective pre-response planning.

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2. Application of the TEF Model in the Bulkley Morice Study Area

The **Time-based Empirical Fire (TEF) Model** is a wildfire simulation tool designed to assess fire likelihood, hazard, and behaviour over large landscapes. In the Bulkley Morice study area (4.15 million hectares), the TEF model is applied to understand wildfire dynamics and inform management strategies.

- **Purpose**: Simulates daily fire spread, assesses wildfire hazard, evaluates climate change impacts, assess effectiveness of possible mitigation treatments.
- **Components**: Ignition, spread, fuel, weather, topography, and extinguishment.
- **Outputs**: Fire likelihood, intensity, rate of spread, crown fraction burned, estimated fire hazard and fire pathways.

Key Topics Covered:

1. **Wildfire Hazard Assessment and Modelling:**
   - Wildfire risk is the combination of likelihood and intensity (together called "hazard"), and exposure and susceptibility (together called "vulnerability"). The TEF model assesses hazard.
   - In 2026, the project will collaborate with Dr. Hussam Mahmoud (Vanderbilt University) to look at community vulnerability for select communities in the project area.
   - TEF is a landscape wildfire hazard model designed to assess wildfire relative likelihood and hazard over large areas but a short time frame (1-40 years). May be used to assist with tactical forest management and hazard reduction planning.
   - Key components of modelling wildfire include ignition likelihood, rate of spread, and fuel, weather and extinguishment.
   - The BuMo wildfire hazard framework consists of a combination of factors:

- **Likelihood** – times burned,
- **Fire pathways** – community and value exposure to fire,
- **Fire intensity**- informs wildfire management and impacts,
- **Rate of spread** – how fire could move,
- **Crown and surface fraction burned** – informs management strategies

2. **Fuel Types and Fire Behaviour:**
   - TEF uses a fire susceptibility layer to inform fire behaviour. This layer can be either empirically derived from field data and satellite imagery or interpreted from the Canadian Fire Behaviour Predict System (FBP). While the FBP system has been broadly applied in Canada it does have its limitations, for example there are not well described fuel types for the BuMo area. However, FBP fuel types can be greatly improved by adapting the standard fuel types to local conditions.
   - Fuel types and their arrangement significantly influence fire behaviour, spread, and intensity.
   - Dense, young stands and deciduous forests can resist fire spread under some conditions, while beetle-killed stands and continuous fuel pathways increase fire intensity and hazard.
   - Factors like stand structure, connectivity, and moisture levels impact fire intensity and spread.
   - Strategic fuel treatments, such as thinning, pruning, and creating fuel breaks, can reduce fire intensity and improve suppression effectiveness.
   - BuMo-specific hypotheses include:
     - Recent clearcuts burn well
     - Stands with beetle-kill burn well
     - Old growth may burn less than mature
     - Deciduous stands inhibit fire spread
     - Dense young stands resist fire
     - Burned areas inhibit fire for 20+ years
     - Site preparation, including broadcast burning, inhibits fire for 20+ years
     - Thinning treatments with pruning and debris removal (especially under burning) resist fire in some ecosystems
3. **Key model inputs and uncertainties**
   - Historical daily weather. April 1 – October 30 for years 2014-2024
   - Fuel types. Uses 2023 and 2024 data. Fast changing following disturbances (e.g. grass types, slash types, deciduous and non-fuel types).
   - Grass curing factor
   - Spotting. Important to understand how cross “no”/”low” fuel areas
4. **Calibration and Validation of TEF Model:**
   - Calibration involves matching model outputs to historical fire data (e.g., 2018 fires >100 ha, n=34).
   - Validation tests compare model predictions with actual fire data from 2024 fires (fires >100ha., n=19).
5. **Comparison with other models**

   Burn-P3 vs TEF
   - At a high level, Burn-P3 is similar design objective to TEF

- Some fine-scale differences. Burn-P3 invokes the fire growth model Prometheus for the modelled fire spread
  - designed to predict growth of a specific fire under specific conditions (finer-scale than TEF)
  - deterministic (TEF is stochastic)
- Why use TEF instead of Burn-P3? Flexibility and potential to connect with other models (e.g. forest landscape models).

5. **Climate Change Impacts:**
   - Climate change is a major driver of increased wildfire frequency, intensity, and spread.
   - Rising temperatures, reduced summer precipitation, and increased moisture deficits contribute to more extreme fire weather conditions.
   - Non-linear effects of climate change, such as faster spread rates and longer fire durations, amplify wildfire hazards.
   - Projections: Increased temperatures, reduced summer precipitation, and higher moisture deficits by 2055.
   - Effects on Wildfire: Increased ignitions, faster spread, longer durations, and higher intensity fires.
6. **Uncertainty and Complexity:**
   - The accuracy of fuel type classifications and their impact on fire behaviour predictions need refinement.
   - The effects of climate change on wildfire initiation, spread, and extinguishment remain complex and require further research.
   - The effectiveness of landscape-level fuel treatments
   - The approach to assessing resilience indicators is still under investigation
   - Non-linear interactions between factors like fuel, weather, and topography make wildfire behaviour complex and challenging to predict.

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3. <u>Preliminary Results of Beta Version Model Runs</u>

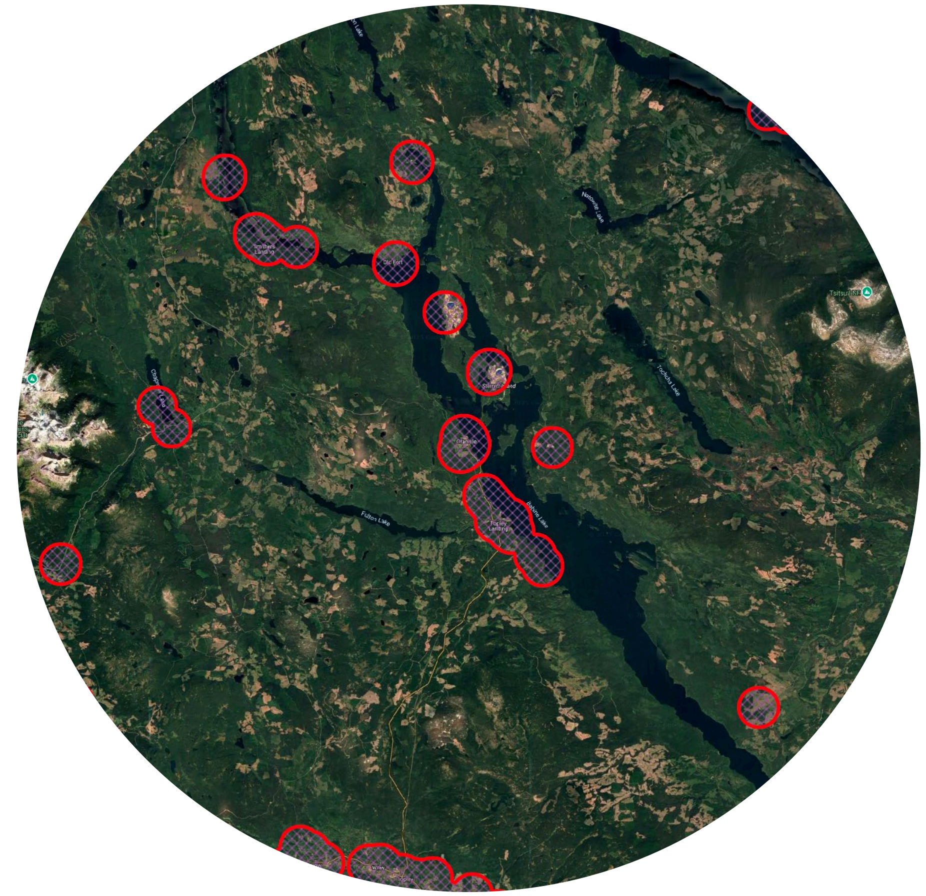
- **Relative Likelihood of Burning**: Identifies areas with high fire risk based on fuel, topography, and weather patterns.
- **Times burned:** Effects of fuel, topography and wind pattern
- **Fire Intensity**: Estimates the heat, fuel consumption, and rate of spread to assess hazard levels.
- **Fire Pathways**: Maps potential fire routes to communities and ecosystems, helping to guide mitigation strategies.

Break out Group Discussion

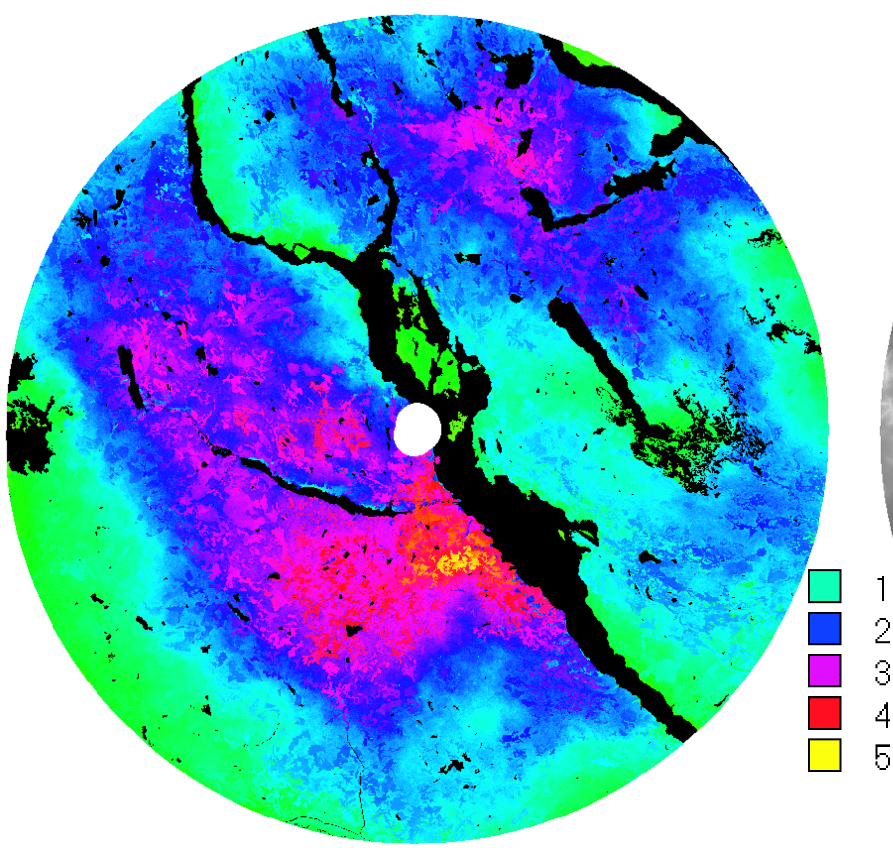
Relative Likelihood of Burning

1. Communities near Lake Babine: WUI around Granisle

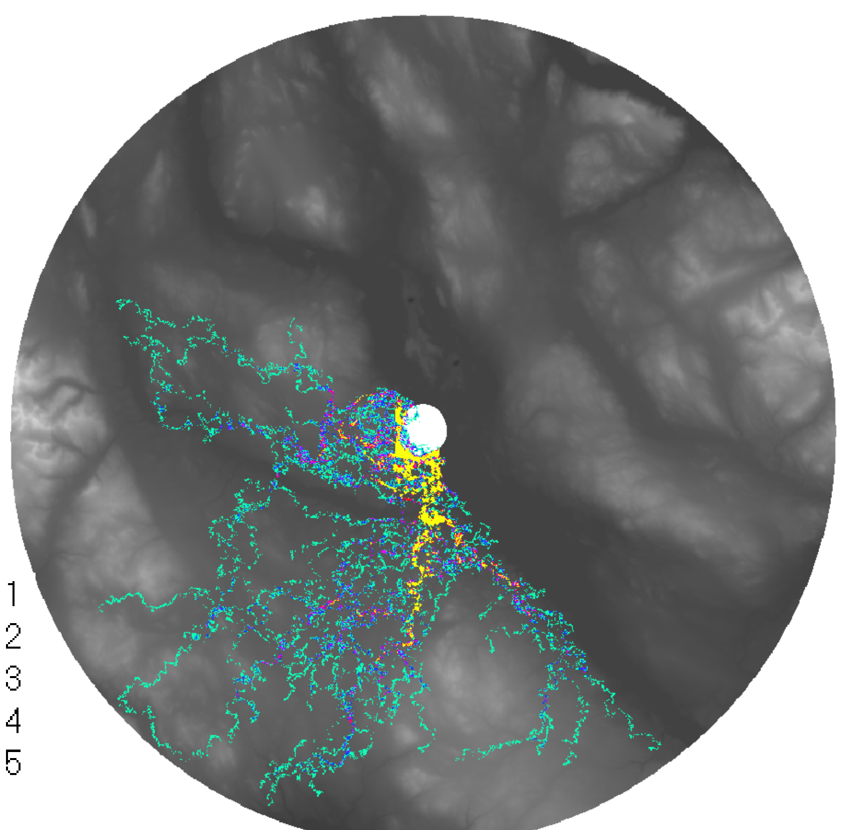
- What are the primary drivers related to relative burn likelihood?
- What are key uncertainties, and ways to improve?
- What are some strategic/tactical decisions that might use this type of info?
- What would be useful information and how could it be displayed?



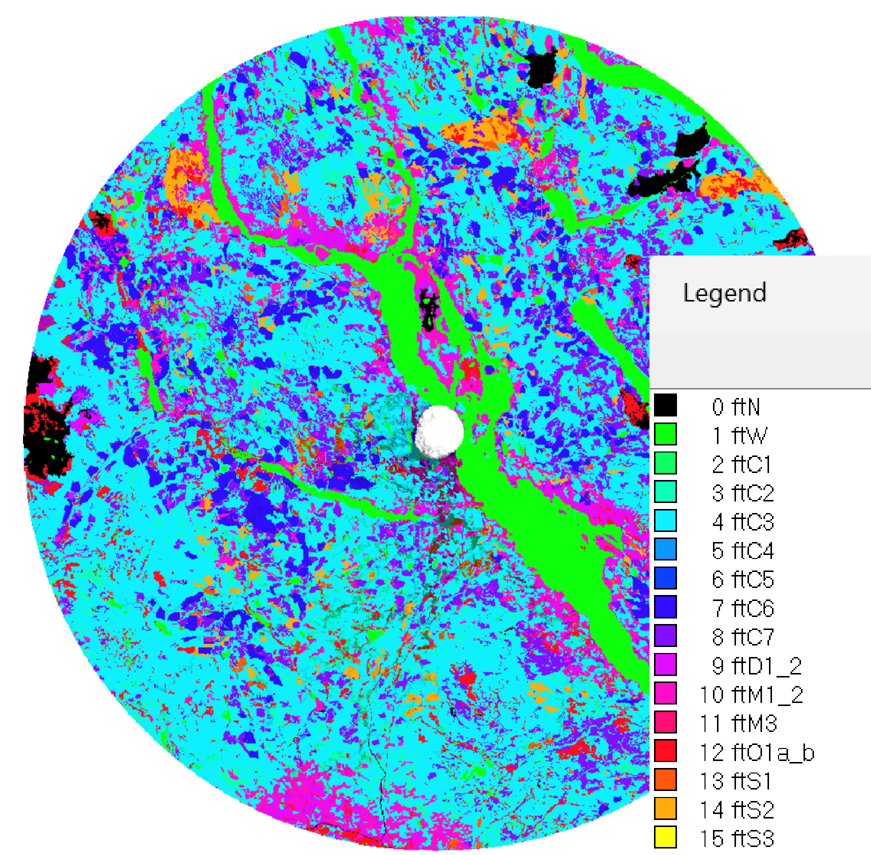
Times Burned (within 40km)



Fire Pathways



Fuel Type (2024)



Break out Group Discussion

Relative Likelihood of Burning

1. Forest values: Core Ecosystem south of Babine Mountains

- What are the primary drivers related to relative burn likelihood?
- What are key uncertainties, and ways to improve?
- What are some strategic/tactical decisions that might use this type of info?
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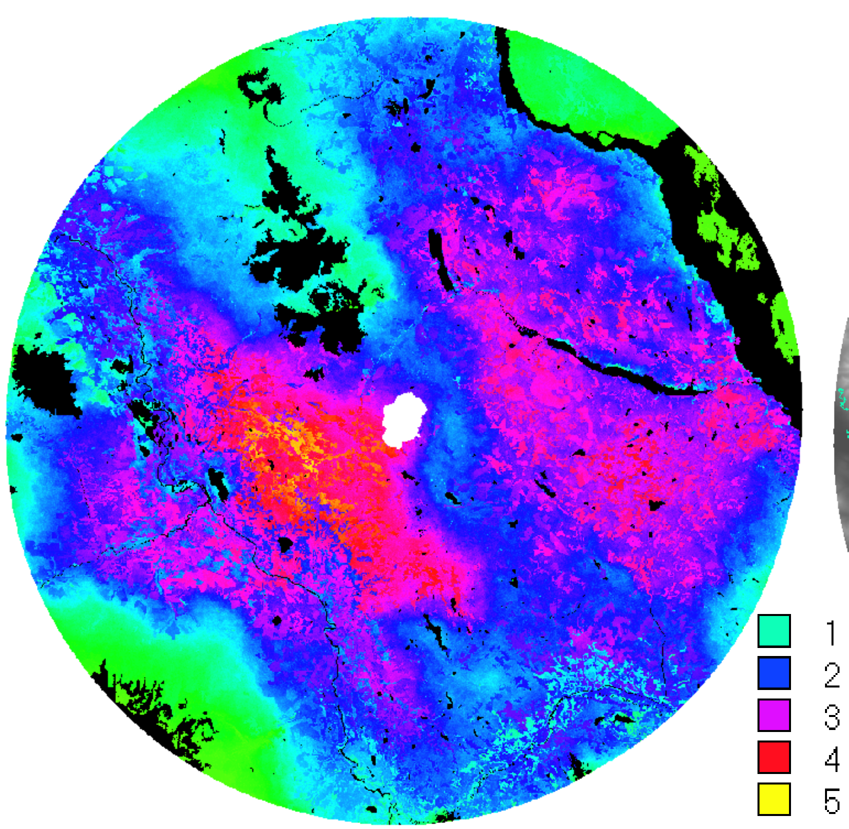
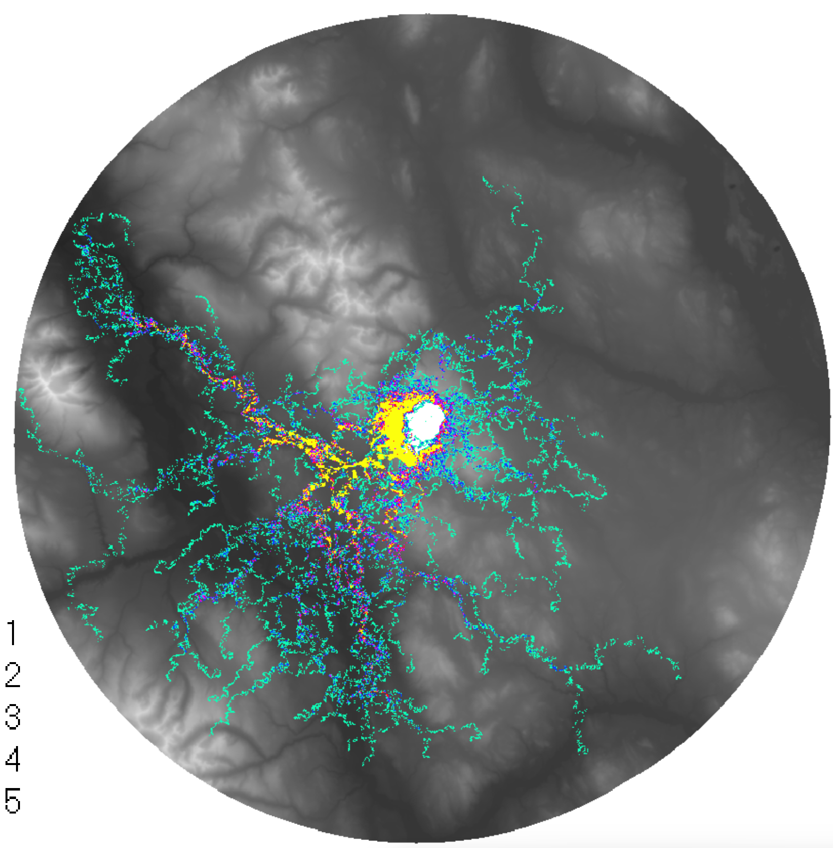
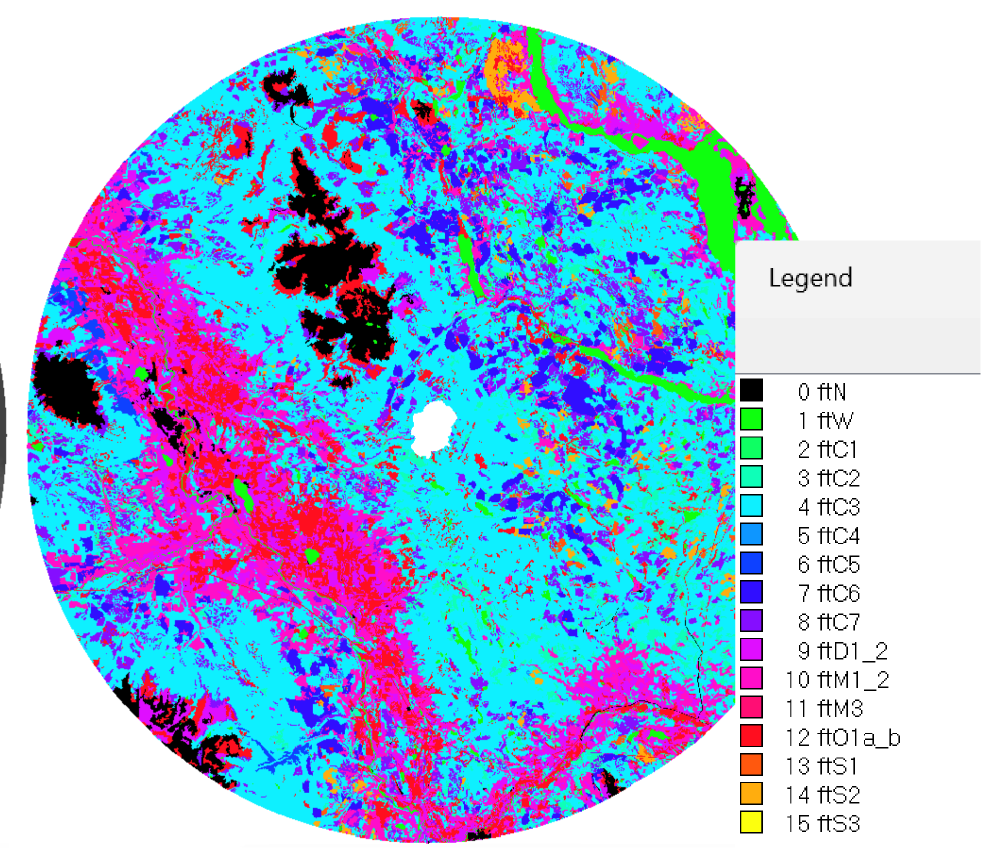
Times Burned (within 40km)



Fire Pathways



Fuel Type (2024)



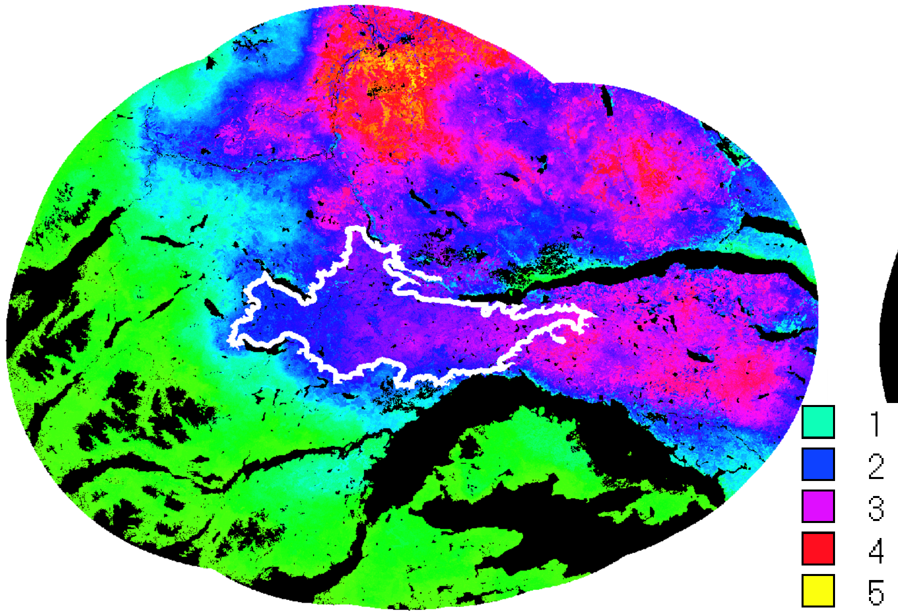
Break out Group Discussion

Relative Likelihood of Burning

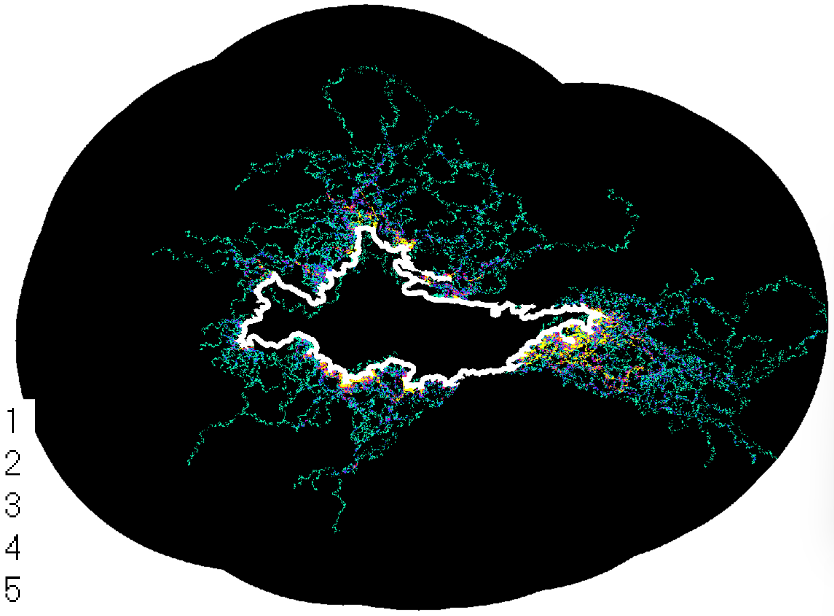
1. Recent burned areas: Nadina Fire

- What are the primary drivers related to relative burn likelihood?
- What are key uncertainties, and ways to improve?
- What are some strategic/tactical decisions that might use this type of info?
- What would be useful information and how could it be displayed?

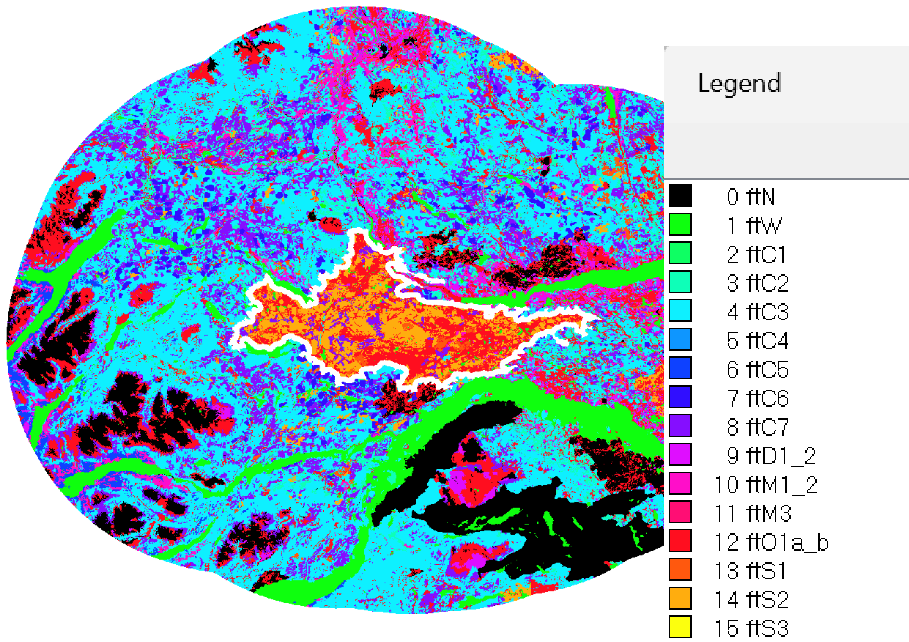
Times Burned (within 40km) (ignited outside Nadina Fire)



Fire Pathways (to Nadina Fire from within 40km)



Fuel Type (2024)



Break out Group Discussion

Relative Likelihood of Burning

1. Recent burned areas: Nadina Fire

- What are the primary drivers related to relative burn likelihood?
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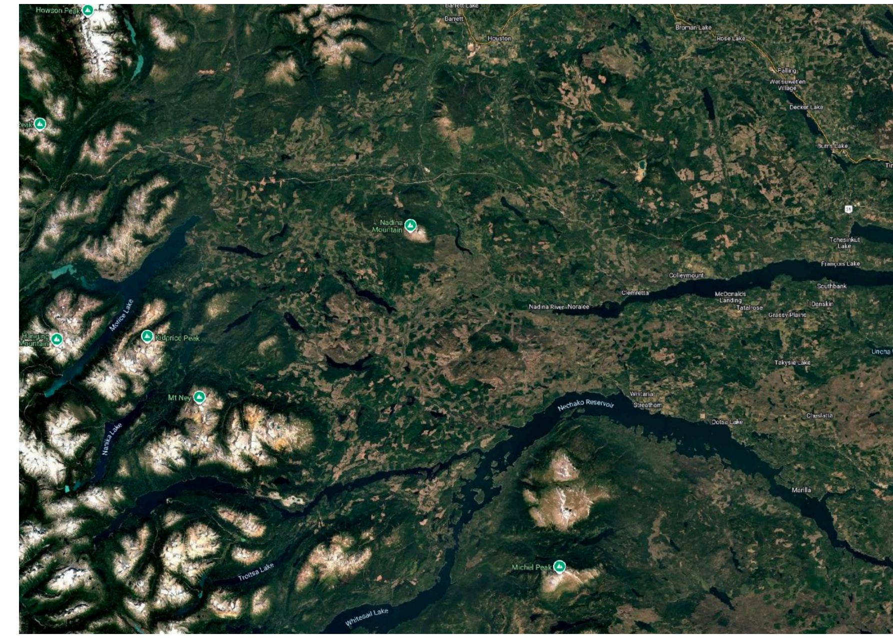
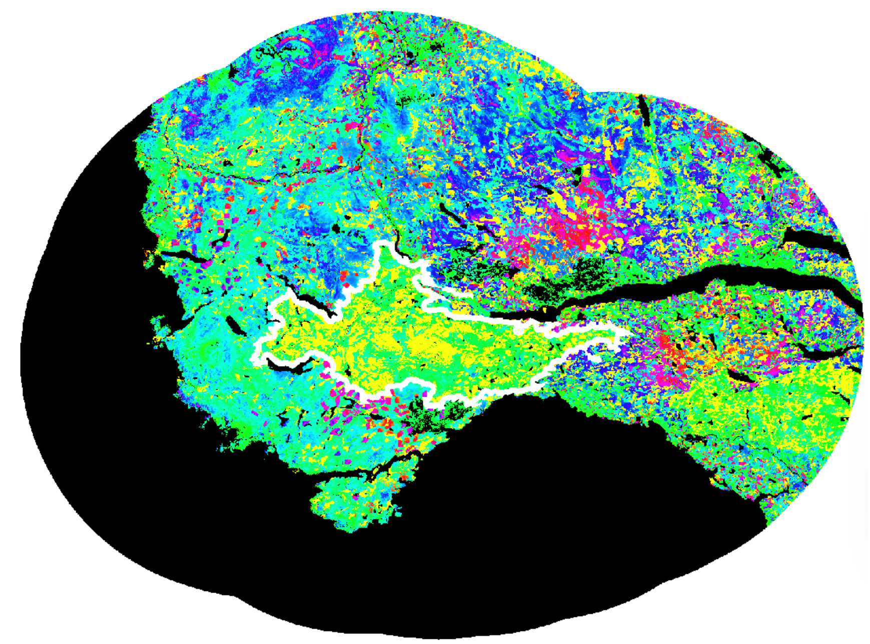
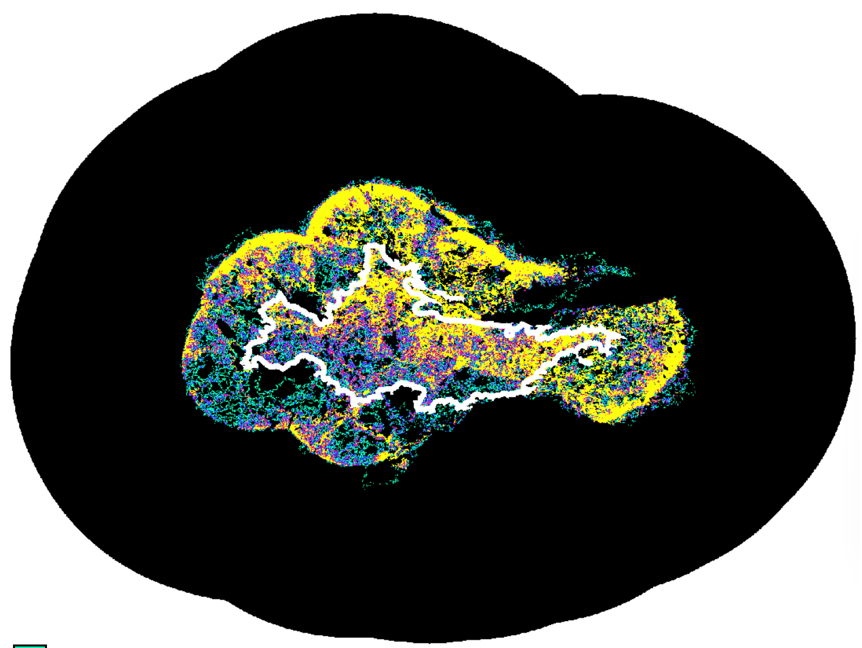


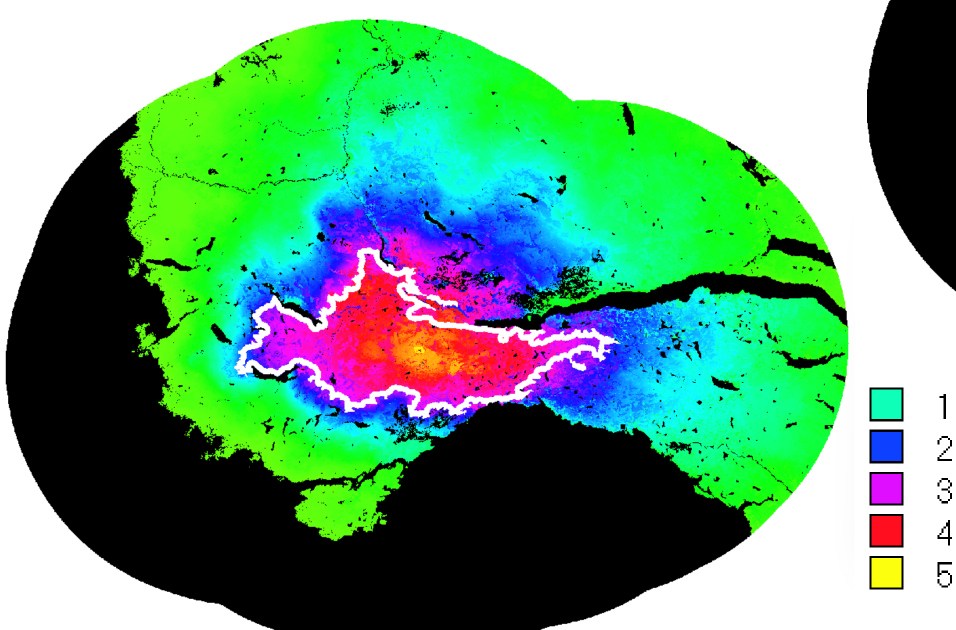
Fire Intensity



Fire Pathways
(from Nadina Fire to 10km away)



Times Burned (within 40km)
(ignited within Nadina Fire)



Colours:

- Green: < 1,000 kW/m
- Light blue/dark blue/purple: 1,000-3,000 kW/m
- Pink/red: 3,000-5,000 kW/m
- Yellow: > 5,000 kW/m

4. Learning and Management Scenarios

- **Learning Scenarios:** Used for educational purposes to explore wildfire dynamics and test ideas without real-world consequences.
- **Management Scenarios:** Focused on decision-making and policy development to guide wildfire and land management strategies.
- The BuMo project will undertake learning scenarios
- Learning scenarios will evaluate mitigation treatments under constrained and unconstrained conditions helps identify optimal strategies for hazard reduction.
  - Simulate how much treatment is required to make a significant difference in wildfire hazard
  - Simulate the landscape effect of treatment arrangements on wildfire hazard
  - Simulate how different harvesting techniques affect surface fire spread.
  - Simulate climate change impacts on wildfire behaviour.
- Potential Operational Delineations (PODs) are proposed as a strategy to improve suppression effectiveness and guide risk reduction treatments aimed at reducing extreme fire behaviour.

5. Participant Reflections on the Day

- Interest in a deeper dive on the fire pathways to understand how it can inform suppression readiness, response and risk mitigation
- How do high-hazard areas interact with other values in the project area
- How can PODs be used to guide future harvesting
- Use this information in the short-term to inform planning and monitoring in an adaptive management approach
- Excited to see the opportunity for wildfire knowledge and planning to be integrated with forest planning
- Opportunity for improved knowledge to be incorporated into the BCWS prevention program
- Persistent barriers to cultural burning remain. Hoping that this project can help remove barriers
- Optimistic about seeing the hazard modelling outputs. It is on the right track
- Reminder that forestry is only one sector affecting multi-value resources. Need to also consider cultural planning.

6. Conclusion

The TEF model provides a powerful tool for understanding wildfire dynamics in the Bulkley Morice study area. Simulating fire behaviour and hazard can help land managers and policymakers make informed decisions about wildfire mitigation, community protection, and ecosystem resilience in the face of climate change.

Wildfire resilience is closely tied to the fire regime. Maintaining or restoring historical fire patterns through strategic fuel treatments, prescribed burns, and adaptive management can help reduce fire severity, maintain biodiversity, and support the ecosystem's ability to recover from disturbances.

Next steps

- Model adjustments and re-run the current conditions hazard assessment (January -February 2026)
- Confirm scenario parameters and roll out initial results with the Steering Committee (February - April 2026)
- Workshop #4 in 2026. Date to be confirmed
- Publish a series of bulletins in 2026
    - Current conditions and fire regime description
    - Climate change effects
    - Mitigations
- Spring seminars